THE ELECTRICAL WORLD

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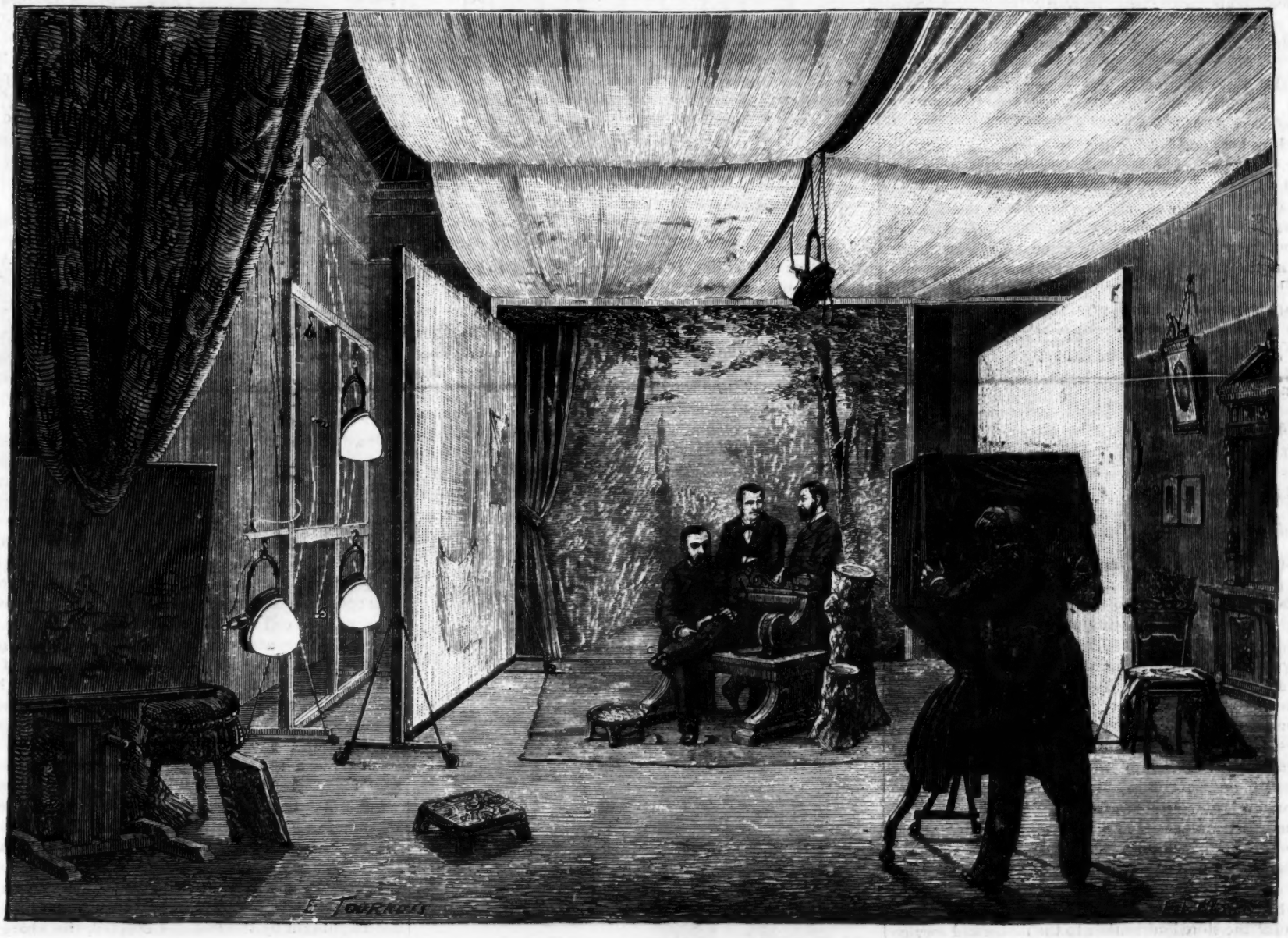
The Electric Light in Photography.

Now that the aid of electricity is sought so earnestly in all the arts and sciences, it would be strange indeed if that popular agency were not utilized by photographers. It may not be generally known that as remotely as 1842, in England, Sir W. R. Grove called attention to his method of engraving the image on the plate by a voltaic current, the active principle or means being chlorine liberated from hydro-chloric acid, in which the picture, attached to the positive pole of the battery, had been immersed. About twelve or thirteen years later, Becquerel, in France, again resorted to electricity for help in impressing the natural colors of the object on the picture at the moment it was taken. This employment may be regarded, however, as subsidiary and incidental, while the present use of the electric light is a matter of the first importance.

No sooner had electric lighting passed from the stage of laboratory experimentation and become a practical reality of everyday life, than it was thought possible to use it in photography. Even in the early days, when the lighting apparatus was cumbersome and work was largely done by rule of thumb, it presented many advantages over sunlight, subject to all the atmospheric variations and eccentricities that are studied by the Signal Service and that afford an endless theme of conversation to the world in general. In this country, where the skies are not often heavily overcast, there are days when the photographer, relying on the sun alone, is unable to take pictures, and in New York and other large cities the sky is certainly not becoming clearer as population increases and smoke-belching manufactories spring up. If we take such countries as England and Ireland, it is found that the light of the sun is insufficient for photographic purposes during a good third of the year. But in default of daylight, the artist was not able to depend on gas, oil, wax or tallow, their light being deficient in the violet, and especially the actinic rays of the upper end of the spectrum, to whose influence are due the chemical changes necessary to the formation of the picture. Magnesium light was tried, but it was expensive, and it could not be sufficiently diffused to give good results.

Hence it was that to the electric light a warm welcome was accorded by many leading workers in the photographic field. Still, on its first trial, the results given by the electric light were not very encouraging. The photographs taken by it, from a single strong but flickering lamp, presented the most vivid and ghastly effects of light and shadow, and invariably suggested that the artist had carried his camera "down among the dead men." Little by little, improvement came, until perfection was reached by such eminent photographers as Mr. William Kurtz, of this city, whose achievements we described and illustrated last September. Mr. Kurtz, using the Excelsior lamps in special form, has by increasing their number and by ingenious devices, succeeded in diffusing the light and in working all the year round, at all hours of the day and night. On May 31 of the present year, we also published a paper by Mr. G. H. Sherman, of Elgin, Ill., who has contrived so to diffuse the light from a single Van Depoele lamp as to take what we know, from personal inspection of them, to be admirable photographic portraits. The work of Mr. Vander Weyde in this department, too, has a deserved and world-wide repute.

The subject is a highly interesting one, and we therefore, to afford an opportunity of judging whether they do these things better in France, reproduce from *La Lumière Electrique* a fine cut illustrative of the use of the "Sun" electric lamp at the studio of M. Boscher, Avenue de Wagram, Paris. Four of the Sun lamps are used there. One is suspended, as shown, in the middle of the posing room, from the ceiling, under a white sheet or canopy. Its light, toned down slightly by a frosted globe, is directed upward against the canopy, which reflects the rays. This lamp is attached to a cable strung longitudinally, in such a way that it can be moved to and fro by means of a pulley cord, at the will of the artist, according as more or less light from above is required. By this arrangement the upper part of the subject is well lighted. A double frame, resembling a clothes-horse, mounted on small wheels, carries the other three lamps, which have opalescent globes, and can be swung laterally so as to send their light toward the middle of the sitter's body and thence downward to the feet and platform. In order that their rays shall not fall too directly on the object, with the undesirable result of violently contrasted lights and shades, a large screen of white material, over which rose-colored gauze or muslin and similar diaphanous material can be put, is interposed between the lamps and the platform. Another screen, opaque, is put, as the picture indicates, close to the camera, with the like intention of assisting in the diffusion of the light. Beyond this, the walls of the studio are light in tint.



THE SUN LAMP IN BOSCHER'S PHOTOGRAPHIC STUDIO, PARIS.

The methods adopted afford an excellently soft and efficient light, and while the diffusion is readily obtained, the intensity can be easily increased or diminished at any chosen point. The time necessary to posing is hardly longer than that required when sunlight is depended upon. The cartes de visite in the albums at the Boscher Studio, show that hereafter the lovers of good photographs will not, in Paris, be subject to the caprices of sun and cloud. It will immediately occur to the reader that in winter, more than at any other season, and at night more than during the day, there are great numbers of persons who wish to be photographed in costume for the stage, the opera, the ball, the reception, the wedding or the masquerade. No one need trouble to dress again, as necessary with photography by daylight, but can come before the camera in all the

pristine glory of the finery, at any hour after sundown. This advantage was referred to by a photographer in New York, at the time of the heavy fogs this year, in the following language: "We are independent of the weather and go right on with our business whether the sun comes out or not. All our plates are taken with the electric light, but in printing we have been accustomed to rely upon the sun. But if Old Sol fails to come to time, we shall have to fall back on the artificial light altogether. We have been doing so during the past fortnight on all work which did not admit of delay." The public is gradually ridding itself of the notion that the sun is a necessary agent in photography.

A very full description of the Sun lamp, with three illustrations, was given in No. 3, Vol. 2, of this paper, and we need not therefore go into a detailed account of it now. It was invented by M. Clerc, and belongs to the arc-incandescence class, in which the arc produced between the two carbons renders incandescent an intervening strip or block of refractory material. In the latest form of the Sun lamp, of which any account has appeared, the carbon rods have a fixed position, are very short, and are placed on each side of a small block of marble, which, when heated, diffuses a golden radiance, perfectly steady, free from all changes of tint, and producing an effect that can only be compared with that of sunlight. The two rods mentioned approach each other very nearly, but a hole in one of them allows another rod to pass and to make contact with the solid rod, and form an arc. The rods are pressed forward by springs as consumed, and the springs form short circuits when the carbons have reached the end. On the lamp bracket is a safety switch that allows the current to pass, one portion along the German silver resistance coils, with two mercury cups connected by a metal fork, and another portion across the main circuit, then along the hollow carbon rod and across the end of the small carbon rod to the other, and out to line. The current may fluctuate without affecting the steadiness of the light, as it takes the marble block some few seconds to cool, and thus its stored-up heat and luminosity supply the deficiency for the time. Another advantage is the fixity of the luminous area and the large light-giving surface of the block. The white marble in a 1000-candle power lamp lasts about thirty hours, and each block costs about six cents. The cost of the carbon consumed is about the same. The small hole formed in the marble for the arc becomes burnt out to a slightly larger size than its original ¼ in. diameter. The Sun lamp has been used with good results as to brilliancy in many public places in France and is now in use at the South Kensington Museum, in London. One objection raised to it is that it is not economical. An estimate, taken at least a year ago, however, as to its return is that a lamp of 864 candle power absorbs 1½ horse-power, and a lamp of 1152 candle power exactly two horse-power. But it seems probable that the Sun lamp, with its beautiful golden light, its steadiness and its general adaptability is destined to enjoy great popularity.

An Important Lighting Experiment in England.

The South Eastern Brush Company, England, are making a most important experiment in house-to-house lighting at Colchester, by means of the B. T. K.—Beeman-Taylor-King—system. The following description of the working is given by Mr. Frank King, electrical engineer of the company, and the cuts are reproduced from the London *Electrician*.

The distinctive features of the B. T. K. system are the use of secondary batteries or accumulators placed in favorable positions for reducing the length and dimensions of conducting cables. Dynamo machines capable of generating electric currents of any high electromotive force, so as to charge a large number of these secondary batteries at one time, although situated at a long distance from the dynamo or generating station. Rocking switches—actuated by a special cell, being one of any set of secondary batteries and called the master cell—which break the charging circuit when the operation of charging is completed, and which shunt the stored current on to the mains and service wires for the supply to consumers, and which at the same time convert the high electromotive force which existed during the charging process to the standard E. M. F. required by the lamps in use. For this purpose there are alternate sets of batteries and rocking switches, so that while one set of batteries is being charged the other set is in supply, and by the time the maximum current is required, say, in the evening, both sets of batteries will have been fully charged, and will therefore have been cut out of the charging circuit, and will be connected to the supply mains.

This alternation of sets in charge and supply is said to be made quite automatic, so as to require no attention to this part of the plant beyond an occasional inspection.

The engine for driving the dynamo machines was built by Messrs. Davey, Paxman & Co., of Colchester, and is 25 H. P. nominal, semi-portable type, and capable of exerting 90 horse-power, when working at 133 revolutions per minute. It is connected by belting from the fly-wheel, which is 7 feet in diameter, to a 4 feet 6 inch pulley on the counter-shaft, and from pulleys of 5 feet diameter on the counter-shaft, by belting, to two No. 8 Brush dynamo machines.

These are the largest machines of this type at present made, but a demand for machines giving twice the current at the same or a higher E. M. F. will no doubt be met as required.

The machines at present in use give a current of 9.5 to 10 ampères at an E. M. F. of about 1,800 volts, when rotated at a speed of 700 to 750 revolutions per minute. They are connected together in parallel arc, or for quantity, thus acting as one machine, and giving a current up to nearly 20 ampères.

Some little difficulty was at first experienced in arranging the two machines for running together, so that each produced its quantum of the work, and so balanced the work of the other. The machines being originally constructed for arc lighting, also required some modification to convert them to their present purpose, and they are therefore separately excited by means of a small "Victoria" dynamo, which passes a current of about 10 ampères round the field-magnet coils of each. This "Victoria" dynamo machine was constructed to specification by the Anglo-American Brush Corporation for the Southeastern Brush Company, and gives an E. M. F of 150 volts when working through an external resistance of 7.5 ohms. This method of excitation of the magnetism allows of great adjustment of the strength of the magnetic field, so that the power expended in charging less than the maximum number of cells is nearly proportional to the number in charge at any time. The adjustment of the strength of the magnetic field of the large machines to the requirements of the circuit is accomplished by means of an automatic regulator, which limits the supply of current to the field-magnet coils in the large machines. It consists of two electro-magnets, the armatures of which actuate contact-breaking apparatus in connection with a small electro-motor, and which cause the armature of the motor to rotate in either direction, according to the manner in which the connection is made with the source of supply. The

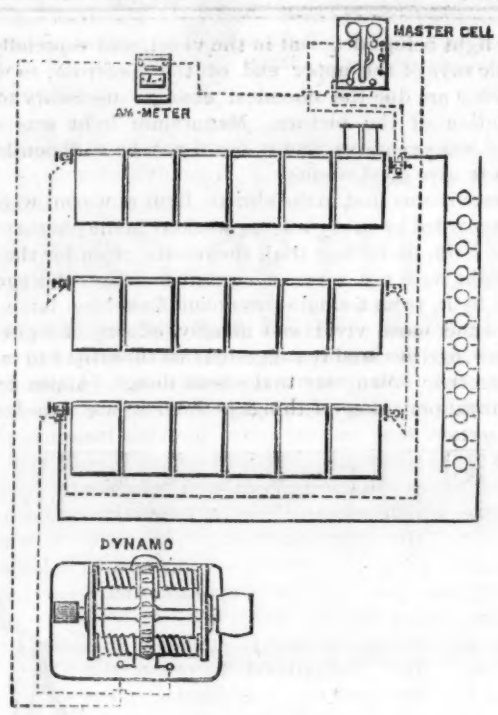


FIG. 1.

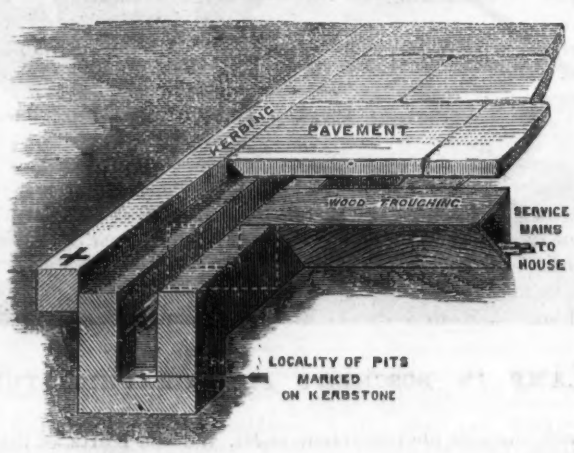


FIG. 2.

rotation of the armature of this motor then actuates a sliding contact, which increases or decreases the resistance in the field-magnet circuit of the "Victoria" machine. The charging current is passed through the coils of the electro-magnets of the regulator, and fluctuations in the current have their effect on the armatures, causing them to be attracted or released according as the current is above or below the normal amount. When, in consequence of an excess in the charging current, one of the armatures is attracted to its electro-magnet, connections are made to the motor in such manner as to cause its armature to rotate, and so actuate the sliding contact, and add resistance in the field-magnet of the "Victoria" machine. This decreases the electromotive force generated, and thus lowers the current in the field-magnet coils of the large machines until the strength of the charging current is again brought to its normal.

The generation of currents of high electromotive force by means of the Brush dynamo machine presents some difficulties when it is necessary that the maximum E. M. F. should be available at any instant. This arises from the fact that the current generated by these machines is not absolutely continuous, but is a series of waves or pulsations caused by the commutation of the current in which the circuit is broken three times in each revolution of the armature. As a result of this peculiarity it is impossible to run the machine in open circuit when separately excited, and to obvite this difficulty a switch and resistance was constructed.

The switch is mounted on a board carrying three current metres. One of these shows the amount of current circulating in the coils of the field-magnets of the large machines, another shows the current passing in the resistance coils, and the last shows the current passing in the charging circuit. The first position of the switch carries the current generated by the large dynamos through the resistance coils, and the amount of resistance in ohms being multiplied by the reading of the current metre, gives the value of the electromotive force generated in volts, and on this reaching its maximum the switch is moved to the second position, and the current then passes into the charging circuit. The resistance coils also serve to load the engine up to the amount of work required from it, and thus prevent the pull up and consequent strain which would take place, where from running almost light a load of 80-horse power were suddenly put upon it.

The rocking switch, by means of which apparatus the accidental presence of high E. M. F. in houses is an impossibility, as at the instant of breaking the circuit either of charge or supply both circuits will be interrupted for a moment, consists of two rows of 18 iron cups containing mercury, mounted at opposite ends of an insulating base. In the centre of this base a cradle is fixed, in which the rocking bar carrying the contact pieces is suspended by steel centres. Sixteen of the cups at one end of the base are connected alternately with the positive and negative poles of the cascades of batteries; the two remaining cups at this end being connected respectively to the positive and negative poles of the charging main. Connections are made on the underside of the base from the 16 alternate positive and negative cups to 16 of the cups at the other end of the base, so as to make eight cups on one side positive and the remaining eight negative. A pair of large cups, one at each side, carry the whole of the current to the positive and negative supply mains. The contact pieces carried by the rocking bar are in the form of prongs, which dip into the mercury cups. On the charging side they are in detached pairs mounted on an ebonite bar, so as to connect the positive end of one cascade of batteries to the negative end of the next cascade, and so on. On the supply side the contact prongs are mounted on two copper bars connecting all the positive ends of the cascades to one bar and terminal mercury cup, and all the negative ends to the other bar and cup, and from these terminal cups to the supply mains. The rocking switches are actuated by automatic means, which throw the batteries out of the charging circuit, when the charging process is completed, or so near completion that free hydrogen is rapidly evolved from the positive electrodes, and this operation is carried out by means of the master cell. This master cell is one of the ordinary battery cells, at which a simple arrangement is made for collecting the gas given off from one of the positive electrodes of the cell. The gas is collected in an air-tight chamber which partially incloses one of the positive plates, and which extends a short distance below the level of the dilute acid in the cell. In the top of this chamber is an orifice, in which is inserted a tube carrying a loose diaphragm, which is also made perfectly air-tight. On the top of this diaphragm a plunger rests, and this plunger actuates, by its rise and fall, according to the distension or contraction of the diaphragm, a small contact breaker, which makes or breaks a circuit through the electro-magnet which actuates the rocking switches. It is evident, then, that on completion of the charging process, and consequent distension of the diaphragm by the free gas evolved, the charging current will be interrupted, and the current energy stored in the batteries will be made available for supply by the fall of the bar carrying the contact pieces or prongs on the discharge side of the rocking switch.

The form of electrode used in the B. T. K. batteries, made by the Consolidated Electric Company, has, it is claimed, several features rendering it distinct from any other form. The principle of the plate is the use of a band or tape of lead, cut from the sheet by machinery, which renders one side of the tape cellulated or roughened. In the latest form are used a number of very thin tapes, cut as described, and a thicker tape wound or coiled upon them to the required dimensions and pressed into shape. It is then burnt together at the corners to give rigidity when fitted with a cast lead support or pole-piece. It is then ready for "forming." Each cell of the battery contains 11 plates, the supports of which are connected alternately to copper bars on the outside of the cell, and the copper bars are then provided with a hook attachment for connecting the cells together. They are supported on cast-iron racks which rest on porcelain insulators on the ground, and they can be constructed of any capacity up to 360 ampère hours, the capacity depending

on the degree of formation and the thickness of the active material of the plates.

In the question of cables one of the claims of the B. T. K. system for economy rests.

Mr. King the company's electrician, gives the following information on this point: "We will divide our consideration of the cables necessary for the direct parallel system into two parts: 1st. The cable for carrying the whole current from the generating station to the supply mains in Head street and High street. 2d. The supply mains in Head street and High street; we will suppose that the supply is to be equally distributed along the whole area, and on both sides of the road. 1st. The cables for carrying the whole current, This would be in, say, three branches from the station in Culver street: one branch would go to Head street and the two others to High street in the most favorable positions. The average length of each branch, lead and return, will be about 333 yards. Now, as the total current required would be about 2,000 ampères, we have to transmit along each branch 666 ampères, a maximum of 2 per cent. fall in the electromotive force is the utmost allowable in this part of the circuit, and on a 60-volt circuit this would amount to 1.2 volts. The resistance of the largest cable we use is about $\frac{1}{4}$ or .145 ohm per 1,000 yards, and if we used this size for our three branches we should have a resistance in each of, say $\frac{1}{20}$ or nearly .048 ohm. But to pass 666 ampères through such a conductor as this would be impracticable on account of heating, besides which it would take an electromotive force equal to 666 × .05 or 33.3 volts. Our allowance for fall being limited to 1.2 volts, we should have to use a cable, the copper conductor of which would equal the sectional area of 27 cables, such as the largest we use, and the weight of the cable would be about 25 tons. This would cost at least £3,000 or £4,000. 2d. The mains for supply in High street and Head street. The total length required would be about 5,000 yards, which would be divided, or may be considered as divided, into twelve branches of equal length, each branch being about 416 yards in length, and supplying a maximum current of 166 ampères, with an allowance for variation in E. M. F. of, say 2½ per cent. The resistance of 416 yards of this 19 No. 12 B. W. G. cable will be about .06, and to calculate the fall in E. M. F. when using this cable we must multiply 166 by .06, giving 9.96 volts. But as the current is supposed to be equally distributed, this amount will be divided by 2, and we should have a maximum fall of about 5 volts instead of 1.2. From this it will be seen that a cable would have to be used which would equal in sectional area $\frac{5}{1.2}$, or four of these 19 No. 12 B. W. G. cables.

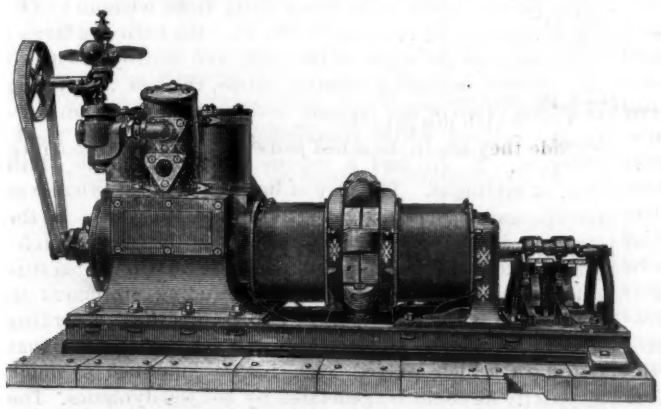


FIG. 1.—DIRECT CONNECTED DYNAMO.

Now, as this size costs about £200 per 1,000 yards, it is fair to assume that a cable four times the weight would cost at least three times as much, or about £750 per 1,000 yards, and as the total length is about 5,000 yards, the cost will be about £3,800, and making in all a grand total for cable of £7,000 or £8,000. I cannot better contrast the cost of cables on the two systems than by the statement that the whole for the supply of 2,000 incandescent lamps on the B. T. K. system have cost about £1,200. The figures speak for themselves, and need no further comment."

The cables as laid for the B. T. K. system are in 21 parallels, each distinct from the other, and branching from six battery stations. This division avoids the use of distributing boxes, and enables the electricians to test any length independently of the rest. They are laid in a brick trench built directly under the pavement, and having wells at distances of 50 feet apart to allow of drainage. The internal dimensions of the trench are 9 inches by 7½ inches, which is ample space for three or four times the amount of cable laid. See Figs. 1 and 2.

The road crossings are taken below the surface of the road, and the channel is supplied with a cast-iron cover, made in short lengths, and with lap joints. The cables can be reached at any place by simply raising a paving-stone when junctions for services are requisite, and the pavement can be made good again in a short time.

BY THE BRIGHT LIGHT.—A series of athletic games by electric light is contemplated by the Williamsburg Athletic Club, Brooklyn, N. Y., to take place some time during August, on the club grounds at De Kalb and Classon avenues. Nothing of the kind has ever been held in this vicinity, and the novelty of the thing will, no doubt, attract a large number of spectators.

Combined Engines and Dynamos.

The requirements of electric lighting have stimulated the inventive and applicative faculties of steam engineers more than has any other industry within the same length of time. Especially has this been the case with reference to engines required for direct coupling with dynamos. No one concern has done more in this line than the Westinghouse Machine Co., of Pittsburg, Pa. We illustrate herewith two of their combinations which possess much practical value; so much so, indeed, that without the combinations many users of electric light would be debarred from its benefits.

The Westinghouse engine is well known to our readers as far as its external appearance is concerned. We have in course of preparation ana nalytical consideration of it for publication in our columns; when we will illustrate its internal arrangements and its working parts. But we will now say that we have had personal experience in an extended use of one of the Westinghouse 6 × 6 engines which we ran for months in an electric light plant at a speed of 450 rotations per minute, and with great satisfaction.

Fig. 1 shows one of these engines connected directly with one of the larger size of Brush dynamos, such as is used for central station lighting. It is compact and convenient of access, as well as presenting the great advantages of dispensing with belts and counter-shafts, which are so troublesome for reasons inseparable therefrom. Belts will stretch so as to be loose just at inopportune moments, or laces will unexpectedly fail to hold the ends together, and that, always, when wanted to work to perfection. Many say that these things happen from the natural perversity of things, or from innate cussedness. It is certain that ordinary care does not insure against failure.

Therefore the electrician hails with delight a practicable apparatus which enables him to lessen his annoyances and delays. In order to gain this *desideratum* it became necessary to provide an engine which could have not only a high piston speed but also a rapid rotation.

Rotary steam engines have not yet been proven of desirable economy, efficiency and reliability. The Brotherhood Three-cylinder Engine has been used to a considerable extent in England, but for some reason neither it, nor its imitations, have been adopted in this country. The Colt Disc Engine has been used to some extent, but with what results we have not been informed.

Fig. 2 illustrates a portable combination consisting of a boiler and Westinghouse engine connected directly to a Brush dynamo. This combination (sometimes with another kind of dynamo substituted) has come to be an indispensible accessory to many, if not all, traveling shows, circuses, and the like. For giving light, such as the speakers cannot give, at political out-door meetings during the present Presidential campaign, this apparatus will shine in more senses than one. It is so handy to move from place to place, according to requirements, that we may expect them to become familiar objects in our streets as they are moved.

FIG. 2.—PORTABLE STEAM DYNAMO.

As a part of the equipment of operative civil engineers in engineering work, such as excavating, bridge and dock building, house erections, and, in fact, all work temporarily carried on at night, it is economically indispensable.

The Turin Electrical Exhibition.

The International Electrical Exhibition, held in connecnection with the Italian National Exhibition at Turin, was opened on May 28. The electrical exhibition is not large, but its quality makes up for quantity. Amongst the three hundred exhibitors, the most prominent are: The Eastern Telegraph Company, London; the Edison Company, of Milan; Siemens & Halske, Berlin; Egger, Kremenezky & Co., Vienna; Ganz & Co., Buda-Pesth; Spiecker & Co., Cologne; R. Alioth & Co., Basel; Sautter, Lemonnier & Co., Paris; the Direction of State Telegraphs, Rome; Cruto & Co., Turin; the Upper Italian Railway Company; Nigra, Turin; Langen & Wolff, Vienna; Gaston Planté, Paris; Ruston, Proctor & Co., Lincoln, and others. The secondary generator of Messrs. Gaulard & Gibbs is exciting considerable interest amongst electricians, as it is claimed to solve the problem of carrying a strong electrical current in thin wires to long distances, whilst hitherto a thick and expensive cable was required for a current of equal power. Thus electric lighting is considerably simplified and cheapened by the introduction of this generator. At the Turin exhibition, twelve spaces are illuminated by this system of electric lighting, which serves to demonstrate its application to domestic purposes.

A DEFINITION AND DESCRIPTION.—"'Lectric wires, indade! Arrah, they'll make foine clothes lines for us poor folks when they rin 'em over these roofs; theyr'e just clane and purty for it." "Och! bad cess to yes if yer tech wan o' thim. Me ould man sez as how one ind on 'em's fastened to the divil's own tail and the ither rests in the furnace o' hell. Yer'd be half way through purgatory afore your washin' was dry."

Tapping Coney Island Wires Again.

David Stewart, a lineman employed by the Western Union Telegraph Company, made the discovery, on the 14th inst., that the line of that company at Coney Island had been tampered with, and at once made a searching investigation, which proved successful. He ascertained that two young men had engaged board at the Arlington House, at Coney Island, and had been assigned to rooms Nos. 35 and 36, which are situated on the top floor of the hotel. Stewart at once went to Chief of Police John Y. McKane's office and obtained his permission to have three trusted policemen accompany him to the aforesaid Arlington House.

At the door of the hotel they met Captain Wise, the proprietor, who stated that two young men had engaged rooms at the hotel about two weeks ago. They asked to be given rooms on the top floor, as they preferred all the breeze that could be obtained at the Island. The rooms were given to them and they appeared to be well suited with them.

Stewart then proceeded to Justice Stryker's office and obtained a search warrant. When he returned to the hotel he was accompanied to the rooms by the policeman and Captain Wise. Room No. 35 was the first to be searched. In this room nothing was found to confirm the suspicions which had been aroused in Stewart's mind. When the next room was searched the carpets were torn up, and when the search was about to be concluded Mr. Stewart happened to look under the bed. With a cry of joy he sprang to his feet and said: "Now we've got it, just look under the bed and see the telegraph instrument."

The men looked under the bedstead and discovered that there was a full set of lineman's tools, and also four telegraph repeaters which were of the finest quality and finish. They had wires attached to them that could be used under water. Over the bedstead in the ceiling was found a hole large enough to allow several telegraph wires to be put through. Inside of the washstand were found a complete battery, and everything that was necessary for a well regulated telegraph office. The instrument and other paraphernalia were then taken to Chief of Police McKane's office, and the lineman notified him of the discovery which he had made.

The instruments were used to tap the wires of the Western Union Company on race days at Monmouth Park and Chicago, and the two men would first receive the messages which gave the name of the winning horses in the various races, and would hold the message until one of the accomplices could go to the pool room at Paul Bauer's Club House and buy tickets on the horses which had won the race. In the course of half an hour or so thereafter the men would send in the original message, and as soon as the names of the winning horses had been placed on the bulletin the accomplices would go to the club house and have their tickets cashed. In this manner they made a heap of money. The men were notified by some of their friends that their secret had been found out and they did not put in an appearance, but left for parts unknown.

They are supposed to be the same parties who tapped the wires of the Western Union Telegraph Company at the Iroquois Hotel last year. The law as passed by the last Legislature makes the tapping of telegraph wires a crime, and the parties, if caught, are liable to imprisonment in the penitentiary for five years and a fine of $500.

THE BELL COMPANY will build a line, with No. 14 wire, between New York and Philadelphia. The line between this city and Boston is working very successfully.

THE OPERA-HOUSE, PARIS.—When the fitting up of this building is finished there will be no fewer than 4,000 incandescent lamps in it ready for use, all over the house, stage, etc.

THE WORK OF THE WESTERN ELECTRIC CO.—The extensive use of electric lights on a number of our prominent buildings, says the Chicago *Times*, adds greatly to the appearance of our down-town streets during the evening. The excellent qualities of the lights displayed on the State and Monroe street fronts of the Palmer House are especially noticeable. The Western Electric Company, of this city, have placed over thirty of their lights in this hotel during the past few weeks.

THE
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ELECTRIC LIGHT HYGIENE.

The insurmountable objection to gas, on hygienic grounds, is that the light it gives is obtained by the vitiation of the air we breathe. Instead of sweetness and light going hand in hand when gas is burned, the light is obtained with a corresponding loss of sweetness, the oxygen that is sufficient for the comfort of five or six persons in a room being consumed by an ordinary gas jet, while the products of gas combustion are injurious to everything that helps to make home life enjoyable. These considerations, and the Health Exhibition in London, perhaps, have led our esteemed contemporary, *Engineering*, to summarize in a most timely and convincing article the evidence that science and experience furnish as to the hygienic and æsthetic superiority of the electric light over all other artificial illuminants.

Taking the figures given in a table from Dr. Tidy's "Handbook of Modern Chemistry," the article we refer to arrives at some rather startling conclusions. Cannel coal gas of the kind burned at Glasgow is the best illuminant among cannel coal gas, common gas, sperm, benzole and paraffin oils, camphine, sperm candles, wax, stearine and tallow; but even that consumes 3.30 cubic feet of oxygen per hour, with a light equal to twelve sperm candles, burning 120 grains per hour. Ordinary gas is far worse. The average gas burner is calculated to give a light of about twelve candles for a consumption of 5 cubic feet of gas per hour. It follows, according to Dr. Tidy's investigations, that each gas burner in a room consumes 5.45 cubic feet of oxygen per hour, completely depriving 17.25 cubic feet of air to that extent of its oxygen in an hour. Now, a sitting room 16 feet long by 10 feet wide and 9 feet high contains 1,440 cubic feet of air, so that one-tenth of the oxygen in it would be consumed in eight hours by the gas of one burner, or all of it in eighty hours, provided no renewal of the air takes place. Unfortunately, in too many rooms where gas is burned the air has little chance of renewal, and all of us know how pestiferous the atmosphere in them becomes, for want of good ventilation, while the gas is alight. Further, Dr. Tidy gives the normal quantity of carbonic acid in the atmosphere as .04 per cent., and holds that 1 per cent is distressing. Each common gas burner, however, delivers in the room 3.21 cubic feet per hour.

Thus the air is deprived of its oxygen and adulterated with poison to a dangerous degree by the gas under whose light most civilized people yet spend three or four hours every night.

This is by no means all. As the ordinary gas burners yield only about one-third of the light that the gas is capable of giving, it follows that owing to the incomplete combustion the gas itself is freely given off into the atmosphere. The watery vapor also given off is hardly to be regarded in the character of a recommendation for gas. It is said that sixty burners will produce on the lowest computation two gallons of water per hour. Then the sulphur present in the gas burns into sulphurous vapor, which passes in the air to the state of oil of vitriol.

So much, though not all, for the perils to which animal life is exposed by the burning of gas. There is some excuse in these facts for the correspondent who wrote to us the other day calling attention to the oxygen cure in cholera, and asking ingenuously, whether the deprivation of the air of oxygen by gas, might not be helping the cholera in Toulon and Marseilles. Without reasoning from cause to effect in that easy but roundabout way, the case is, on the showing of Dr. Tidy, a bad one, and his results have the support of Professor R. O. Doremus, who, in an article published not long since said: "How astonished we should be if our fashionable salons were heated during the winter by a hard-coal fire in the centre of the room, with no device for the removal of the most prominent product of combustion, carbonic acid gas. Yet such is our nightly practice when we light our gas jets and lamps; and our places of public resort, with but few exceptions (those where the electric light is used), afford us the same unwholesome pabulum for respiration." Professor Pickering, too, of Harvard, when making an investigation lately into the cause of weak sight among the students, traced it to the heat given off by their reading lamps, the heat drying up the humors of the eye.

When we come to things inanimate, the case against gas is not less strong. *Engineering* gives the subjoined terse résumé of damage done and noted: "The eminent chemist, Dr. Prout, exposed water in a drawing-room in which gas was burnt, and found that it absorbed sufficient of these vitriolic emanations to redden blue litmus, and show the presence of free sulphuric acid. The fumes from gas will, indeed, in the long run, discolor every sort of fabric, rust metals, rot gutta-percha, and reduce leather (as in the binding of books) to a scarcely coherent powder with a strongly acid taste. The late Dr. Letheby, in an able report on the coal gas supplied to the City of London, gives numerous instances of the destructive effects of these products of gas lighting. Enormous damage has been done to the binding of the books in the libraries of the Athenæum Club, the London Institution, and the Royal College of Surgeons. In the first-named, wherever the books had been exposed to the atmosphere containing the vapors of burnt gas, they were as rotten as tinder; indeed, it often happened that the covers gave way in attempting to remove a book from its place on the shelf. * * * The librarian of the Newcastle Literary and Philosophical Society wrote that a book which had been missing for thirty-six years was sound and good when recovered, while the leather on the books in the same binding which had remained in the library had been utterly destroyed. He further wrote that the ventilators having been fitted over the chandeliers of the library, half a gallon of water is collected a night from the gas that is burned there; this water is so corrosive from the presence of sulphuric acid that it attacks all kinds of metal fittings with which it comes into contact, and thereby acquires a metallic impregnation of copper and iron. Drapers know to their cost how the edges of pieces of dyed fabrics become faded and rotten when kept long on the upper shelves of gas-lighted shops; no plant will grow in a room where gas is burning, and cut flowers quickly wither, while those who work long and habitually in close, gas-lighted rooms become blanched and sickly."

To this we might add that Mr. Andrew Lang, the English essayist, in his admirable work on "The Library," says, with urgent warning, that the book collector must avoid gas, as it "deposits a filthy coat of oil that catches dust;" and that Mr. Blades, eminent in the English bibliographic world, found three gas jets in a small room reducing the leather backs in his book-cases to a dust-like snuff and causing the covers to break away in his hand from the contents.

It has been said that the battle for electric light should not be fought on the ground of cheapness, but on the ground that as compared with gas it is a desirable luxury. We think that the hygienic ground is as good as any for purposes of attack and defense, and that it will include cheapness, as health is an imperative necessity to all, and especially to the toilers in this work-a-day world of machine shops, mills, factories and big stores. The good time coming will be one when the cool, steady, bright, healthy electric light is universal, enjoyed by the poor as well as the rich.

HOUSE TO HOUSE LIGHTING.

We publish in this issue a very full account of the important installation for electric lighting, made at Colchester, England, by the South Eastern Brush Company. This latest development is attracting much attention across the Atlantic, and the promoters of the system entertain the the most sanguine expectations in regard to it. It will be observed that the main idea is that of decentralization, with the object of storing a supply of electricity, so that should any break-down occur at the generating station, all the lights would still be available just as though nothing had happpened to impair the efficiency of the service. The lamps used are incandescent, and the current to run them is stored in accumulators at convenient intervals under the street, arranged and operated in the manner shown by the two illustrations.

This is a notable experiment. Its starting was witnessed by delegates from London, Brighton, Dudley and other interested quarters, and its outcome will be awaited with anxiety wherever anything is known of the electric light. The description of the B. T. K. system, as given by Mr. King, one of the gentlemen responsible for the successful working of it, is perhaps the most favorable presentation of it that could be made. On the other hand, the difficulties of practical operation that have yet to exhibit themselves are already predicted by keen critics. It is shrewdly pointed out that the more complications are introduced into any system of electric lighting the greater is the liability to irregularity and failure, and it is feared that the rocking switches and master cells may give considerable trouble. Of course those who entertain depreciatory opinions of secondary batteries are naturally skeptical as to the practicability of the scheme. The estimate of cost, too, is an assailed point. The company proposes to supply the electric light at a cost very nearly as low as that of gas, which is now selling in Colchester at 93 cents per 1,000 feet.

Whatever be the result of the enterprise, we cannot but think that the company deserves the highest praise for its spirit and for the ingenuity shown in the various arrangements. It also deserves to succeed.

LIGHTNING RODS AND CALCULATORS.

The prevalence of thunderstorms during the month has, coupled with the deliciously cool weather, been a matter of general comment. The damage done by lightning has been remarkably large. The loss by fire last week in Brooklyn at the furniture factory struck by lightning, was not less than $100,000. In New England and in various parts of New York many houses were struck, while telegraph and telephone wires were frequently rendered useless. At Greeneville, near Norwich, Conn., on July 13, an electric bolt fell into the kitchen of the farm-house of a Mrs. McDonald. She felt no shock, but was astounded to see the iron sink detach itself from the wall, spin twice around the room, and fall in small pieces on the floor. At the same moment the stove and every piece of furniture in the kitchen were riddled, and the minute fragments were flung about the woman in a shower. A ground swell set the floor undulating, and the plaster fell from the walls over the ruined furniture. No other room was visited. Another bolt exploded in the street opposite Mr. Durfey's residence, half a mile away, moved his heavy granite door steps several rods up street, and smashed every pane of glass in the lower story front without touching the house. At Roaring Creek, Pa., the barn of a farmer was struck on the night of the 12th, and destroyed with all its contents, including valuable cattle, the loss amounting to $5,000. Two of the farmers' sons and another man were fatally injured while attempting to rescue the stock. Paterson, N. J., had a serious visitation on the 12th also, at midnight. The play of lightning on the wires was terrific, and balls of fire rolled along the car tracks in the streets. Forty wires were burned out at the central telephone exchange, and poles and fire alarm apparatus suffered damage. But the most astounding statement in connection with the display at Paterson is that, according to the newspapers, an electrician gravely calculated that the flash which played such havoc contained as much electricity as could be generated by 357,600 dynamos. The papers are all very precise as to the figures from this new style of lightning calculator, but they all omit any information as to the capacity of the dynamos.

It seems to us that these occurrences and the scores of others recorded by the press within the month, should direct attention to the desirability of using lightning rods, and rods that may be depended upon, of the right height, properly put up and well grounded. We make note today of the interesting experiences with lightning of Mr. Martin, the engineer of the Brooklyn Bridge.

TELEPHONIC FACILITIES IN FRANCE.

In France as in most other European countries, the operation of the telephone is essentially a government monopoly, but, as in England, a private company carries on all the business there is worth boasting of. The Société General des Telephones occupies in France a position not unlike that of the United Telephone Company in England. It has built up a fine system in about five years, and has a working capital of $2,500,000. In 1879, the first licenses were granted by the state for five years, and the time has come round for a reconsideration of the subject, the licenses expiring on the 8th of September next. The royalties derived by the government amount now to something over $50,000 per annum, while about as much more is paid into the national revenue in taxes and commissions. Under these circumstances the government proposes to continue the present arrangements, and to intrust the telephone to private enterprise as heretofore, for commercial development. The royalty is still to be 10 per cent. of the gross receipts, and the term of the license is to be five years. It is proposed to extend the application of the telephone, and to establish, additional to the regular exchanges, call boxes open to everybody at a small charge. The government has already tried exchanges of its own at Reims, Roubaix, Tourcoing, St. Quentin and Troyes, and may go further in that direction later, but at present it does not want to risk any more capital in the business, and would rather draw regularly the substantial royalties payable by the licensees. Extra territorial lines are projected, and altogether the liberal policy promised by M.

Cochery, Minister of Posts and Telephones, is in strange contrast to the restrictive rules adhered to by the English authorities. M. Cochery says: "We must rise to the level of progress made by other countries," and his measure commends itself to general acceptance throughout France.

THE LAW'S DELAY.

We note that in some quarters the final settlement of the litigation in the Bell-Drawbaugh matter is expected at no very distant date, as the evidence is all in, and the lawyers are getting ready for argument. We would gladly see a decision arrived at speedily, but it may not come quite as soon as wanted. David Dudley Field, who ought to be well informed on these subjects, said once of court delays in New York: "Then, when once begun, how it is dragged along; what long arguments on points of evidence; what badgering of witnesses; what insults to parties; what irrelevant testimony; what reams of shorthand notes long drawn out, till finally the case is given to the court! When will it decide? Who can tell? It may be in a month, or three or six months. The decision is at last pronounced. Then comes an appeal to the General Term. It takes a month or several months to prepare for the appeal, the argument is had in three or six more and the decision follows in another month, or by the end of the next quarter, or the next half year. Finally the General Term decides, and in one instance out of every three reverses the trial-judge and sends the case back for a new trial. Suppose, however, the first judgment affirmed, the case goes then to the Court of Appeals, and such is the accumulation of arrears in that court that it can hardly be reached in less than eighteen months." And even that does not exhaust the possibilities of a prolonged lawsuit in the present century of grace.

CUTTING RATES.

The new schedule of rates of the Baltimore & Ohio Company went into effect this week. Day rates are reduced to twenty-five cents for ten words, between New York and Chicago, and night rates to fifteen cents for fifteen words between all points east of St. Louis. The Mutual Union Company now announces that messages will be forwarded by it between New York and Chicago at a twenty cent rate, or a cut of five cents under the Baltimore & Ohio Rate. This is only what we expected and predicted, but it strikes any observer as ridiculous and farcical that the Western Union Company, of which the Mutual is but a component part, should meanwhile pretend to go on doing business at the old prices.

The Combination of Western Union's Rivals.

The Baltimore & Ohio, the Postal, and the Bankers & Merchants' Telegraph Companies have at last entered into a pooling arrangement which amounts to a consolidation of the three interests, so far as their working operations are concerned, for the next twenty-five years. The negotiations for a union were opened about two weeks ago, and were concluded on Thursday. Under the pooling contract the companies will be operated as one corporation, with D. H. Bates, President of the Baltimore & Ohio, as the executive, and G. S. Mott, of the Bankers & Merchants', as general manager. Each company will maintain its separate organization, and the management of the system will be vested in the executive committees of the three companies, the majority vote of the executive committee of each company to count as one vote in the management of all.

It is expected that eventually the powers now given to these committees will be delegated to Robert Garrett, John W. Mackay and James Gordon Bennett. The combination includes what are known as the Mackay-Bennett cables.

All of the earnings of the companies are to go into a common treasury, and after the expenses have been disbursed under the authority of the committees mentioned, the remainder is to be divided upon a basis not yet made public. All of the companies are to complete their lines now building before the contract goes into effect. Should it be considered necessary by the majority in interest for any one of the companies to extend its lines further, the work is to be done by that company, and bonds are to be issued for the exact cost of the new line, and these bonds will be guaranteed by the other two companies.

The union of these companies brings under one control over 16,000 miles of pole lines and 120,000 miles of wire lines, connecting all the principal cities east of the Missouri River and south as far as Galveston. The united companies will have under this arrangement four lines between New York and Boston, with branches to Newport and Fall River; four lines between New York, Philadelphia, Baltimore and Washington; five lines between New York and Chicago, having in the aggregate fifty wires, one of these lines being on a direct route by way of Binghamton, Elmira and Cleveland; two by way of Albany, Buffalo, Cleveland and Toledo, including the line on the West Shore & Buffalo and Nickel Plate railroads; one by way of Philadelphia, Harrisburg, Pittsburgh, Cincinnati and Indianapolis; one by way of Philadelphia, Baltimore, Pittsburgh, Wheeling and Cincinnati, on the route of the Baltimore & Ohio Railroad; three lines from Chicago to St Louis; one line from Chicago to St. Paul; one line from St. Louis to Kansas City and Omaha; one line from Cincinnati to St. Louis; one line to New Orleans and Galveston from Washington by way of Richmond, Danville, Augusta, Atlanta, Ga., and Montgomery, Ala., with branches extending from Richmond to Norfolk, from Columbus to Charleston and from Augusta to Savannah; Atlanta, by way of Cincinnati, Louisville, Nashville and Chattanooga, and a second line to Galveston and New Orleans by way of the Gulf, Colorado & Santa Fe Railroad.

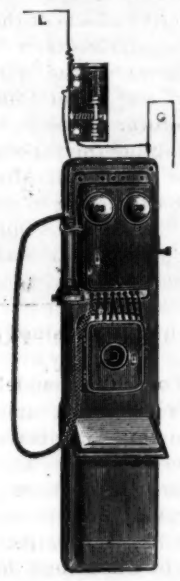
These are joined together by various local connecting lines, including two through the oil regions, between Buffalo and Pittsburgh, and a line from Toledo to Detroit, and from Syracuse to Ogdensburg and Montreal.

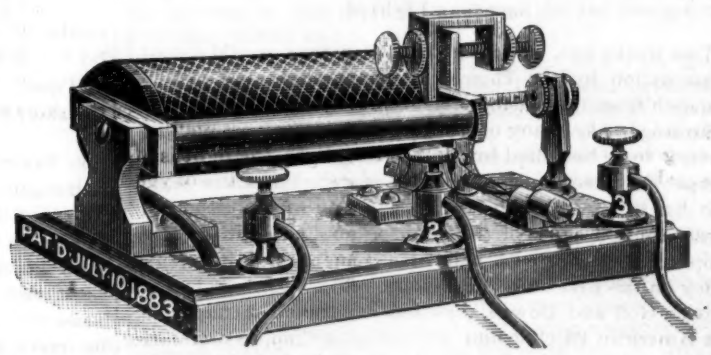
This combination includes the Commercial quotation or ticker system now in operation in this city and Philadelphia, and soon to be started in Chicago, Boston and other principal cities; district telegraph or messenger service in the principal cities and the McDonough telephone system. The whole will be operated in connection with the Bennett-Mackay ocean cables.

In this arrangement between the three companies neither assumes nor becomes responsible for the fixed liabilities of the others. The expenses of operating will be reduced as nearly as possible to the cost of running one company, while the business will be extended to the fullest capacity of the united lines.

The American Automatic Lightning Arrester.

There can be no doubt that telephone wires "crossing" other electric wires often take up a current that damages the instrument and causes more or less danger to the building in which it is fixed. These wires, too, not infrequently form an inviting path for lightning, with equally dire results. Many a nervous householder or business man





AMERICAN AUTOMATIC LIGHTNING ARRESTER.

inquires anxiously, when the telephone is put up, as to the liability to sudden fire under which he puts himself, and it sometimes happens that his worst fears and forebodings are realized, when he becomes highly skeptical as to the benefits of the telephone.

But there are remedies for this evil of abnormal current, and one of them submitted to our inspection lately seems in every way calculated to afford thorough protection against lightning and overcharge from other wires. It is put on the market by the American Automatic Lightning Arrester Company of 52 Broadway, this city. It consists, briefly, of an electro magnet, an armature with a vertical lever and contact points, as in a relay, which instrument the protector resembles. Under normal conditions the electro-magnet is in direct circuit with the telephone box, and does not in any way interfere with the working, but as soon as the current becomes excessive and strong enough the armature is attracted, a shunt circuit is at once formed around the telephone, and the excess passes to ground. The danger thus having been avoided, by its interposition, the protector readjusts itself automatically, and "comes up smiling" for the next bout. Practical tests show the device to work admirably, and there ought to be a good demand for it, as every one using telephones will use such an appliance.

The instrument can be seen in practical operation at the offices of the company, which has for sale shop or State rights for the exclusive manufacture and sale for the Eastern and Western States.

Lightning on the Brooklyn Bridge.

"We would like to have lightning whacking at the Brooklyn Bridge all day," said Engineer Martin yesterday, "if it will only leave the masonry alone. I know a good many people think there is danger of lightning striking the bridge while they are crossing in a storm. When the bridge police were appointed they all had to be reassured on that point. There is not the slightest danger to one crossing the bridge, because it is a perfect conductor of lightning, being of steel and iron, and the electric fluid readily finds its way to the anchorages. About twenty-five feet from the outer surface of the anchorages the cables are attached to immense chains formed of flat pieces of iron bolted together. These chains terminate at the lower end in a metal plate, which is in contact with the moist earth, and when you can form a perfect metal connection between the spot where lightning strikes and the moist earth below there will be no damage done by a thunderbolt.

"What we must look out for is to keep lightning away from the two towers. You have noticed that the two flagstaffs, one on each tower, from which the bunting occasionally flies, are never removed. Each staff supports a heavy copper wire which terminates above in a sharp pike. The rod runs along the top of the tower and over its edge to one of the large cables on the land side of the tower. Once on the cable, the bolt could do no harm. If lightning were to strike the tower, the presumption is that it would be attracted by the copper wire. Lightning performs some strange freaks, though. I saw in Lima, in this State, a good many years ago, a bolt strike a locust tree twenty-five feet high which stood by the side of a church over 100 feet high, with a lightning rod on it, too. However, if lightning should strike the masonry at any spot not guarded by the wire, not much harm could be done. So I think we have the bridge protected from lightning."

"Has lightning ever struck the bridge?"

"Yes; when the Brooklyn tower was nearly completed, and the cables connected the cities, lightning struck a derrick on the tower and disabled the mast, and then passed down to the main cables and thence to the ground. I stood at the time in the archway of the New York tower, and was leaning the point of my elbow against the masonry. Immediately after the bolt dropped I received a shock by induction, as the current was passing on the cable not far from me."

Commercial Telegram Stock.

Referring to the action brought in the Supreme Court recently by Henry C. Gardiner against the officers and Directors of the Commercial Telegram Company to compel them to account for the $1,000,000 representing the stock and the difference between the par value of the stock and the sales made at $30 and $50 a share, Mr. S. W. Fullerton, a Director and the former President of the company, made a statement to a *Times* reporter on Thursday. "The Commercial Telegram Company," he said, "was organized by Luther E. Shinn, George W. Casper and myself for the purpose of constructing and maintaining telegraph lines and the operation of telegraph printing instruments for reporting market quotations and commercial news. The company was created on the basis of a capital stock of $50,000, divided into 500 shares of $100 each. The certificate of incorporation provided that the capital stock might be increased, and it was subsequently increased to $1,000,000. This was done not only in accordance with the law but in accordance with a custom usual in such cases." The company, Mr. Fullerton said, had "met with strong opposition from the old Gold & Stock Telegraph Company," but it had thus far overcome all opposition and had been surprisingly successful. Several hundreds of the instruments invented by Stephen D. Field had been manufactured for the company and are now in active use. No one but Mr. Gardiner had ever disputed the value of these patents and inventions.

Many statements in Mr. Gardiner's complaint were characterized as gross falsehoods by Mr. Fullerton. "If Mr. Gardiner's statement that he paid $6,000 to Gov. Richard C. McCormick for his 100 shares of stock is true," said Mr. Fullerton, "it speaks well for Mr. McCormick's estimate of the standing and prosperity of the Telegram Company. It is not true, as asserted by him, that 300 shares of the original stock of the company was voted by the incorporators to Mr. Shinn, or that the remaining 200 shares thereof were voted to Mr. Casper and myself. It is not true, as he states, that the Board of Directors directed that the increased capital stock of $1,000,000 be issued to themselves, nor was it so issued. It is not true, as stated by him, that Mr. Shinn divided the proceeds of a check for $1,000,000 with Mr. Field, Mr. Casper, and myself or with any of us. It is not true that the Directors of the company have dissipated its capital, nor is it true that the incorporators conspired against the interests of persons who might become purchasers of the stock of the company."

Mr. Fullerton admitted that Mr. Shinn gave 3,750 shares of his stock to the company, of which 2,000 shares were

made preferred stock, but he said that this transaction took place long before Mr. Gardiner became a stockholder. Mr. McCormick, who then held and owned the identical stock afterward sold by him to Mr. Gardiner, signed a written consent with all the other stockholders of the company that these 2,000 shares might be made preferred stock, and be entitled to preferred annual dividends of 6 per cent.

The Wooley Headlight.

The engine which drew passenger train No. 3 of the St. Paul road out of the Union depot at 9 o'clock last night, says the Chicago *Tribune*, had a headlight of remarkable brilliancy. It was the first electric arc headlight put on an engine running out of Chicago. This application of the electric light is the invention of Wooley, an Indianapolis man. Several days ago his agent, Mr. R. Huncheon, sought permission of Mr. George O. Clintog, superintendent of the Chicago division of the St. Paul road, to place one of his lights on a locomotive of the road as an experiment. A guaranty was given that the result would be attended with no accidents, and permission was granted.

The apparatus, which consists of a small one and a half-horse-power rotary engine and a box about two feet square by eight inches in thickness, containing the dynamo, etc., was placed upon engine No. 541. The apparatus is placed just above the running board and directly in front of the cab on the left-hand side. The first run was made from Milwaukee to Chicago Wednesday night. The operators all along the line inquired of the office in Chicago what sort of a headlight train No. 12 had. Mr. Huncheon fitted the device to the engine and rode in the cab all the way down. The focus had been so adjusted as to cast the light a little to the right of the centre of the track. It was arranged that the same engine should pull the night passenger out last night. A number of railroad officials from different roads gathered at the depot to view the new headlight. The light was exceedingly brilliant, and its power was estimated by Mr. Huncheon to equal 2,000 candles. It was remarkably steady and no flickering could be observed. The light is under the entire control of the engineer, like the air-brake, and he can vary its intensity at will. It is claimed that it will be possible to produce a 4,000-candle light for the purpose.

Saratoga Lighted.

Two weeks ago, we stated that Saratoga would enjoy illumination by the Thomson-Houston light. A special dispatch from that fashionable resort says:

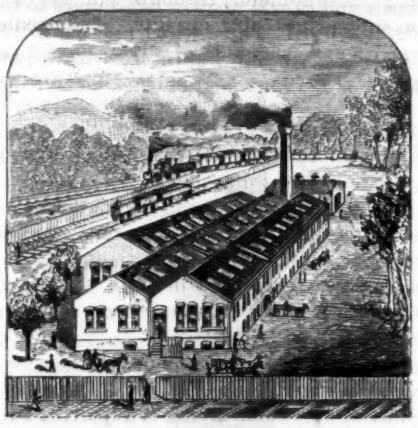
Saratoga, like many of the other famous summer resorts, is to be benefited by the electric light. Several attempts have been made in former years to introduce electric lights here, but in each case failure has attended these efforts because of the inferior quality of the light proposed, together with bad management and incompetency on the part of the promoters. Some few weeks ago Messrs. Goff and Downs, president and vice-president of the American Electric and Illuminating Company of Boston, visited Saratoga for the purpose of looking the field over, with a view to establishing a central lighting station here under the American or Thomson-Houston system of electric lighting. The inducements held out were so favorable that the company decided upon building a station. Active work was commenced less than four weeks ago, since which time the work has been pushed along night and day, under the immediate personal supervision of Mr. C. B. Cushing, the American Company's representatives and Mr. Downs, brother of the vice-president of the American Company. Boilers, engines, machinery, lamps and wire lines have all been constructed new, and to-night steam was turned on for a trial test, President Goff and Vice-President Downs having come on from Boston for that purpose. A more complete success could not have been desired. The lights were turned on in the station, Grand Union, Congress Hall, Hawthorn Spring and the new skating rink, besides several other places, and worked most successfully from the start. Hundreds of visitors from all parts of the country universally pronounced them the best electric lights they have ever seen. The hotels and business houses here are delighted with the new light, and the company will meet with splendid success. The company has opened a branch office here at 37 Broadway, and are already negotiating with several prominent capitalists visiting here for the introduction of this excellent system into some eight or ten different cities in various parts of the country.

The Manufacture of Insulated Wires.

The Callender Insulating and Waterproofing Company, a branch of the London Company, gave on Friday, the 11th inst., a reception at their works, East Newark, N. J., to gentlemen representing the various telegraph, telephone and electric light companies. The guests were conveyed to the works by a special train on the Erie road. Among them were Messrs. George A. Hamilton, electrician, W. U. Tel. Co.; A. S. Brown, assistant general manager, W. U. Tel. Co.; J. E. Fenn, W. U. Tel. Co.; W. A. Vail, Metropolitan Telephone Co.; O. A. Seeley, Metropolitan Telephone Co.; H. A. Palmer, Metropolitan Telephone Co.; W. Maver, Jr., Baltimore & Ohio Telegraph Co.; Theo. Mace, Electrical Supply Co.; R. Maynicke, representing Geo. B. Post & Co., the architects of the factory; Charles G. Francklyn, late of Cunard Co.; James Thompson, of Foster & Thompson, Wall street, counsel for the company; A. J. McDonald; W. W. Biddulph, of London. Many gentlemen invited sent letters regretting their inability to be present.

The works at East Newark, N. J., are situated on the Erie Railroad, about ten miles from New York and two miles north of Newark. They stand on high ground, and the company has secured five acres of land surrounding. The main building is two story, brick, 120 × 185, with detached boiler room. The basement is devoted to the manufacture of the bitite, the processes being kept secret. Adjoining is Dr. Lugo's laboratory, which will in due course be fitted with all the best modern appliances for accurate work. In the northwest corner of the basement is Mr. Dallas' testing room. The testing table is a large slate slab resting on brick pillars, 10 inches thick and about 5 feet wide, the pillars running 4 feet above ground and 6 feet under ground, and giving a firm foundation. Here is used S. Bergmann & Co.'s galvanometer of 5,000 ohms resistance; also a 100,000 ohms resistance box in sections of 25,000 each; a Wheatstone bridge, with resistance box of 50,000 ohms; another with box of 30,000, etc., etc. Throughout the testing department everything necessary to accurate work is provided.

The offices occupy the southwest corner, and are very neatly fitted up in oak and ash. To the left, entering from the west, is the tank-room where the reels of wire are placed in water after being finished to cool and harden, and to be connected with Mr. Dallas' department for testing before shipment. Further on to the left in a large room



THE CALLENDER INSULATED WIRE FACTORY AT EAST NEWARK, N. J.

are powerful machines for grinding and for rolling the bitite into strips. From these it is taken to a table to be cut up into strips, and then the strips are put into a massive screw machine, where the copper wire is covered with compressed bitite. Next the wire is run from the machines through two troughs about 50 feet long and then to the reels, preparatory to going into the braiding-room, immediately to the right. In this room are a number of machines for winding tape diagonally around the large wires or cables before running it through the bitite machines, and it contains also powerful machines for braiding wire for large cables. The braiders were made by T. Larmith & Co., Salford, England. From them the wires are taken to a small steam tank called "the painter," where a combination of bitumen is run on them filling up every crevice, and from the painter the wires go on reels to the water tanks to cool and to be tested.

A number of highly satisfactory experiments were made showing the resistance of the material to heat and cold, and a most favorable verdict was pronounced by the experts present. We hope shortly to publish exact data as to the electrical capacity of the insulating material.

The company are using a Porter-Allen engine of 75 H. P. The boilers are one of 100 H.P. and one high pressure of 400 lbs. capacity. All the machines in use are the special design of the company. The works were planned and equipped under the special supervision of Mr. W. M. Callender, the secretary, assisted by Mr. Dallas, the superindent, a gentleman of great experience; and the task has been accomplished in a very creditable manner. The building was erected by Mr. Ch. R. Hedden, of Newark. It is stated that later on the works will be enlarged in order to enable the company to manufacture its own copper wire, and so lessen the cost of the product, although its insulated wires are already known favorably, not alone for efficiency in underground and submarine use, but for cheapness.

After the exhibition mentioned above, which was witnessed with much interest and pleasure by the visitors, came an enjoyable collation. The party returned to New York in the evening. Mr. W. M. Callender will be glad to supply information as to prices, samples, etc., upon personal or written application at the office, 7 Nassau street.

We understand the arrangements are being made with the Electrical Supply Company among others.

DAFT'S electric railway is now in successful operation on the new pier at Coney Island. During the last week it has carried from 2,500 to 3,000 passengers.

Troubles at the Miscellaneous Stock Exchange.

An animated dispute and a fistic encounter attracted people to the rooms of the Electric, Manufacturing and Miscellaneous Stock Exchange at about 4:30 p. m. on Wednesday, the 16th inst. This Exchange has occupied the basement of the Duncan Building, Nassau and Pine streets, since its organization last December. From the language used by some of the members that day it is evident that trouble has been brewing in the concern for some time.

The Miscellaneous Stock Exchange was organized for the purpose of giving marketable quotations to securities not listed by the New York Stock Exchange, and of enabling brokers to trade in such securities. Many reputable business men believed that there was a demand and a legitimate field for an Exchange of this kind. The Exchange, which was admirably fitted up, has been kept open every business day since its formal opening in December, but there has been little business done there. Memberships which originally sold for $250 each have declined in price to about $15. The quotations of the Exchange were forsome time given in this paper, but were recently dropped.

A meeting of stockholders was to have been held in the rooms of the Exchange on Wednesday afternoon for the purpose of receiving the report of a special committee, appointed July 3, to investigate certain charges concerning the management of the institution. E. C. Benedict, the first vice-president, took the chair. Mr. Whitney, chairman of the committee, stated that his asrociates, John B. Brown and William R. Wilson, and himself had prepared their report and were ready to submit it. It was discovered, however, that a quorum of the Exchange was not present. There were but 46 members in the room out of nearly 300. Some of the members wanted to adjourn until the last Thursday in September, but the majority voted to adjourn until next Monday. It was generally believed that the committee's report was adverse to the superintendent, and that it recommended the immediate winding up of the affairs of the institution.

There was a great deal of lively talk before the assemblage broke up, and one of the members, a gentleman of foreign birth named Hochat, denounced the Exchange as a fraud. Superintendent Lassen resented this declaration, and, after the mutual interchange of some mildly angry words, he informed Mr. Hochat that he "was a liar and a fool." The foreigner's blood was up in an instant, and so were his fists. He struck Mr. Lassen a smart blow in the face. Mr. Lassen attempted to return the compliment, and the two men clinched. They were separated, but hostilities were soon renewed, and some of the Superintendent's friends laid violent hands on Mr. Hochat, and when, a few minutes later, he was helped into a carriage he presented a very disheveled appearance. The noise attracted the attention of passers-by and caused a temporary blockade of the sidewalk on the west side of Nassau street.

Electric Light Patents.

To the Editor of The Electrical World:

SIR: I send you herewith a copy of the opinion of Judge Shipman in the suit of Brush vs. Condit. This suit was commenced on December 3, 1880, and has consequently been pending nearly four years. The defendants of record, Messrs. Condit, Hanson & Van Winkle, were at that time the selling agents of the Weston Electric Light Company, and the suit was brought to restrain them from selling arc lamps of the Weston system and the Weston copper-plated carbons. The defense was, however, assumed by this company, which soon afterward succeeded to the business of the Weston Company. Various other suits have been brought by the Brush Company against users of the Weston arc system, and this was made a test case and was tried with very great care and elaboration on both sides. The testimony, exhibits and briefs cover about 2,500 printed pages, the complainants' brief alone being 448 pages in length, and there were also a large number of arc lamps and models put in evidence. The case was argued before Judge Shipman at Hartford in March last, by consent of counsel, and the oral argument occupied eight entire days.

Both the patents upon which the suit was brought were at the outset extremely broad in their terms, and, if they could have been sustained with a liberal construction, would probably have gone far toward establishing for the Brush Company a monopoly of electric arc lighting.

Two disclaimers were filed during the trial by which part of the claims of the patent on arc lamps were abandoned and the remaining claims materially restricted, and Judge Shipman now decides the patent to be entirely void. We made out so strong a defense to the patent on metal-plated carbons that the complainants asked leave at the hearing to withdraw this patent from the suit, and the only question submitted to the court in regard to this patent was as to the terms on which such leave should be granted. The withdrawal of the patent under such circumstances amounts practically to an abandonment of it.

I write you this explanation thinking that, as this is the first important suit in which electric light patents have been involved, and as it has attracted a great deal of attention, you may desire to understand the facts in the case.

LEONARD E. CURTIS, Secretary,
U. S. Electric Lighting Company.

NEW YORK, July 17.

How To Construct a Galvanometer.

BY THOMAS R. TALTAVALL—PART VI.

(CONCLUDED.)

As will be seen by reference to Figs. 8 and 10, in part III., the wire composing the coils of our instrument was wound in two sections—one on each side—and little or none at the centre. It is evident, from this arrangement of the wire, that the field will be denser at the sides of the coil than at the centre, and that the more the needle is deflected the denser will be the field its poles will penetrate. As the seat of action in the needle is at the poles, it is of little consequence how few the lines of force are at its centre—the fewer the better, because then we will have more to concentrate on the poles.

When the position of the instrument has been adjusted for use, the needle will point north and south and the pointer will come to rest over the zero mark on the scale. The way to find this position is to turn the instrument around until the pointer indicates in the manner above noted that the needle is in the magnetic meridian. The ends of the instrument will face the north and south also.

Magnetic needles point north and south by reason of the directive force of the earth's magnetism. To deflect a galvanometer needle from its natural position will require a magnetic force greater than that of the earth. A current of electricity through the wire of the coils will deflect the needle and the deflections will to a limited extent be in proportion to the strength of the current. Thus if a current of the strength of, say, 2 is flowing through any one or all the coils, and deflects the needle ten degrees, a current of the strength of 4 through the same coil will deflect the needle about 20 degrees. The deflection of the needle is directly proportional to the strength of current, within about 15 or 20 degrees; beyond that limit it is proportional to the tangent of the degrees.

More accurate tests or measurements can be made if we confine the deflection of the needle to within 15 degrees.

If we surround a magnetic needle with a single turn of wire and pass a given current through the conductor, and the needle gives a deflection of, say, 5 degrees, a deflection of 10 degrees will be effected by the same current if we surround the needle *twice* with the same wire—all other conditions being equal. This naturally leads us to the conclusion that the greater are the number of turns of wire around the needle, the greater will be the effect of a current thereon. As has already been stated, galvanometer coils are usually subdivided into sections of different lengths and resistances. The selection of the coil best adapted to any particular test, generally depends upon the electromotive force, or strength of the battery and the resistance in the circuit. Thus, for instance, if we want to measure a wire of little resistance and have a good strong battery current, we should use the coil of lowest resistance in order to confine the deflections of the needle to a convenient limit. It is plain that if we should put the same current through a coil of higher resistance (and of a greater number of turns around the needle) the needle would be deflected too greatly to admit of any accurate readings.

On the other hand, if we have a feeble current we should use the coil with the greatest number of turns—or all the coils together—in order to secure the greatest possible magnetic effect on the needle. To pass such a current through a coil of low resistance and few turns, alone, would actuate the needle very feebly.

It will be observed that sometimes the galvanometer needle is deflected one way, and sometimes the other. This is in accordance with the laws defined in part V.

It often happens that when tests or experiments are made, the battery from which we derive our current is inaccessible to us and out of sight, and it is important to know in what direction the current flows through the outside wires into the instrument. The only way we can determine that is by noting the direction of the deflection of the needle.

An easy way to determine the direction of a current through a galvanometer coil, is known as "Ampère's Rule." It is this: Imagine a man swimming in and with the current through the wire, always facing the needle. Then the north pole of the needle will be deflected to his left hand.

This rule is invariable. Of course, in its application, the direction of the winding of the coils of the instrument must be borne in mind.

As the object of this article—to give directions for the construction of a galvanometer—has been accomplished, it will be a fitting conclusion to give a brief description of a few other classes of galvanometers.

The one nearest akin to the instrument we have been considering is the tangent galvanometer. As ordinarily constructed, the coil of a tangent galvanometer is at least six inches in diameter, and the needle, which is seven-eighths of an inch, or less, long, is hung at the centre. It is an essential feature of this instrument that while the coil is large the needle shall be relatively small. The deflections of the needle then are in proportion to the tangent of the degree.

An instrument made after the foregoing directions can be used as a tangent galvanometer with accuracy enough for all ordinary purposes, simply by resolving the degrees of deflection into tangents, then ascertaining the ratio between the tangents.

In most all works on electricity can be found a table of degrees and tangents.

The astatic galvanometer is the most sensitive of all. Its essential feature consists of two magnetic needles, one placed above the other with the north pole of one over the south pole of the other. The two needles must be, as nearly as possible, of equal strength, so that one will counteract the other in magnetic effect. They will take a position in obedience to the torsion of the fibre by which they are hung, regardless of the directive force of the earth. The lower needle is placed within the coil in the regular way, with the upper one above. Sometimes the coil is wound in two sections, so that each needle will be within a coil. In this arrangement the upper and lower sections of the coil are so connected that the current will act on both needles in the same direction.

The differential galvanometer is a very useful instrument. It consists substantially of two coils wound together—that is, winding two wires together in place of one—and so connected that a current passing through one will neutralize the effect of a similar current through the other. When this condition is attained, the magnetic effect on the needle will be null, and the latter will remain unmoved. The least difference in the strength of the current in the two coils will immediately manifest itself by deflecting the needle, and the deflection will be in proportion to this difference. It is plain that to obtain a balance the insertion or withdrawal of resistance would be the simplest way to accomplish that end.

Every one is more or less familiar with the principles of the reflecting galvanometer, through the use of this instrument on submarine cable circuits. The needle which is exceedingly small, has a tiny silver mirror attached thereto. The latter reflects upon a graduated scale a ray of light from a lamp. The deflections of the needle and mirror cause the ray of light to move along the scale, on one side or the other of the "zero" point, according to the direction of the current through the coil. A permanent magnet is usually placed above the instrument to neutralize the effect of the earth's magnetism on the needle, thus increasing the sensibility of the instrument. Galvanometers of this class are extremely delicate. They are sometimes made astatic, which renders them sensitive to the highest degree.

This instrument, with certain modifications, is known as the "marine galvanometer." As its name implies, it is for use on shipboard, on vessels laying or repairing submarine telegraph cables. The peculiarity of this instrument is that the pitching or rolling of the vessel does not disturb the needle. The deflections are just as regular as though the instrument were on a stable foundation.

There are various other forms of galvanometers, constructed for special purposes. They all embody the same principle, however, namely, the action of electro-magnetic lines of force on a magnetic needle.

DEPARTMENT OF INQUIRIES.

While we are pleased to answer in this department all questions of general interest to our readers, and do so without charge for time or expense, we must request those of our patrons who desire information for their personal interest, and who cannot be properly answered in this way to send us with their request a small sum, say from $1 to $5, to pay for the time and the expense incurred for their exclusive benefit.

NO. 88—LIGHTNING.

"Will you please give me some of the most probable ideas or discoveries which have been made as to the causes of lightning?"
WOODRIDGE, N. J. G. H.

There have been many theories. Franklin demonstrated that it is electrical. The theories differ as to the cause of the electrical accumulations and discharges. Some have held that electricity was taken from the earth to the clouds by vapor of water during evaporation, and that the tendency to return to earth finally became so great as to cause it to leap from clouds to earth. Others have held that the electrical condition of the earth due to earth currents or other causes induced an opposite electrical condition of the clouds and that when the tension became great enough a discharge from clouds to earth took place to neutralize the opposite electrical condition. Others have held that as all chemical and physical changes, such as evaporation, condensation, oxidation, reduction, heat, etc., give rise to differences of electrical potential, which differences constantly tend to assert themselves by discharges from points of higher to points of lower potential, the lightning discharges are due to them. For instance, evaporation and condensation of water, being physical changes, produce differences of electrical potential, so that where the evaporation takes place, as on the earth, the potential is lower than it is in the clouds where condensation takes place. The result is silent discharges between the two at some times, and strong, visible sonorous discharges at other times. There are other theories. The fact is, there are no theories which are all sufficient.

NO. 89.—LEARNER'S INSTRUMENT.

"I have a private line of bare iron wire, No. 12, five blocks long and had a Bunnell learner's instrument at each end. Both instruments worked very good for about eight months. I had four cells of Lookwood battery at each end, the copper grounded at one and the zinc at the other. About one month ago, after a storm, I examined the instruments and found both to be affected in some way, for they would not draw at any adjustment; yet I got good battery through the magnets, changed the poles of the batteries, but still no change in the magnets. I then put in a new pair of magnets and they worked O. K. Last week I disconnected the sounders at both ends, and in place used a relay (60 ohms.) and both worked splendidly. When the last storm came on I cut in my lightning arrester, and after the storm cut it out again, but to my astonishment found that the relays would not draw a particle. Where is the trouble?" C. F. M.
NEW YORK CITY.

The cause of the trouble is lightning in both cases. You cut in your arrester too late, or cut it out too early. The magnet-coils are short-circuited. Atmospheric electrical discharges often take place of sufficient magnitude to injure telegraph electro-magnets, though they may not be intense enough to dignify by the term lightning. But, mayhaps, your line has come twice in contact with an electric-light wire.

THE TELEGRAPH.

THE FARADAY'S FLAGLESS BUOY.—The accident by which the bark Chignecto ran into the Faraday's cable buoy in mid-ocean, carrying away the staff and flag, may cause some delay, says the *Herald*, but not much difficulty in finding the buoy again. The position in which the Faraday was when she laid the buoyed end of the Commercial cable was well determined. At noon of the 2d ult. the steamer was in latitude 45 deg. 54 min. north, longitude 46 deg. 27 min. west, and at midnight she had laid 74 additional miles of the deep-sea section (making 840 in all) when she buoyed the paid-out portion. Though the position of the steamer at midnight of June 2 was not stated, it was no doubt determined to within two or three miles. If, on her return to this spot with the eastern deep-sea section, any difficulty is experienced in finding the flagless buoy, she can easily buoy the end of the latter section and then pick up the western section, where it is certainly known to lie a degree or two of longitude to the westward. The moderate depth of water around Flemish Cap, near which the Chignecto struck the buoy, will also facilitate the finding of the cable end in case the buoy is not promptly discovered.

THE TELEPHONE.

THE EXECUTIVE offices of the New England Company, Boston, have been moved from No. 40 to No. 50 Pearl street.

VOICES FROM THE VASTY DEEP.—All the vessels of the British navy that carry divers are to be supplied with telephones, for the purpose of submarine communication.

DEATH OF A SUPERINTENDENT.—Mr. George L. Wheeler, Superintendent of the Northeastern divison of the New England Telegraph and Telephone Company, died at Bansville, N. Y., on the morning of July 10. He was unmarried and belonged to Worcester, Mass.

HAPPY NEW YORK VILLAGES.—The Central New York Telephone Company's extension, connecting Utica with Oriskany, Floyd's Corners, Stittville, Holland Patent, Baker's Mills, Adsit's and Steuben Corners is announced open to the public, and the residents of those villages are happy and more talky-talky, says the *Journalist*, than a society reporter or a half-fuddled candidate.

UNDERMINING THE POLES.—Judge Ingraham, of the Superior Court, rendered a decision on the 14th inst. in the suit for an injunction brought by the New York Metropolitan Telephone and Telegraph Company against the Colwell Lead Company to restrain the defendant from undermining or digging around certain telegraph poles in Thirty-ninth street and Sixth avenue. Judge Ingraham thinks there is no case made out for an injunction and therefore denies the motion.

ERIE INTERESTS.—The directors met in Boston on the 12th to consider the dividend question, but deferred final decision until Aug. 11, when the full returns from all of the divisions for the quarter will have been received. Heretofore it has been customary to estimate the earnings for a month or more, but that course is not considered wise on this occasion. The situation is understood to be this: Five directors favor paying some dividend, say 50 cents per share, and three are opposed to paying anything until the floating debt of $200,000 is reduced or paid. It looks now like a quarterly dividend of 50 cents or none at all. The net increase of subscribers in April and May was 406.

IN LOWELL, MASS., the Telephone Company have been obliged to relocate their mass of wires running from the central office up Central street on account of the erection of the new Weld Spalding building, with which the wires would interfere. These wires, 104 in number, have been inclosed in a lead pipe, forming a sort of cable, which is carried over the Southwick block, reaching Central street again at the second large pole, at the northerly end of the American House, where the cable terminates and the wires again take the insulators. The length of this cable is 600 feet. The Telephone Company have made arrangements with Mr. Spalding for running their wires over the new block if they should wish to do so.

A MOST INTERESTING PROBLEM.—The telephone interests are confronted with a most interesting problem, says the Boston *Transcript*, which, from present appearances, can only be met by advancing the local rates of telephone exchange subscribers. It costs to operate an ordinary telephone exchange, including rentals paid the American Bell Telephone Company, about $40 per annum per subscriber, and the annual compensation received is from $42 to $43, and some additional compensation in the way of charges for extra territorial connections. Now, the growth of the business, instead of reducing the expense per subscriber, increases the expense pro rata, as the number of the connections and the particular service to every subscriber is increased by a new subscription. This can be well illustrated by the supposition of a telephone exchange attempting to connect all the people in a certain state, say a million. Several hundred dollars a year would not cover the expense of the service that each subscriber might demand of the exchange; but this million of people could be sub-divided into many exchanges, and each person served in his own locality for a comparatively small sum of money. The problem of how to limit the growth of local telephone exchanges, either by sub-division of exchanges or by increased rates, is one yet to be solved.

THE ELECTRIC LIGHT.

ABERDEEN, MISS.—The Electric Light Co., in Aberdeen, Miss., start up with the Brush Light and the Westinghouse engine.

FOR AUSTRALIA.—The Westinghouse Machine Co., of Pittsburgh, Pa., have recently shipped to the Government of New South Wales, Australia, one of their 160 horse-power automatic engines, to be used in electric lighting.

WINDSOR, ONT.—The Western Ontario Electric Light & Power Co., of Windsor, Ont., have purchased a Westinghouse automatic engine of 65 horse-power, from Inglis & Hunter, of Toronto, who are licensed builders of this engine for Canada.

LYNN, MASS.—The Thomson-Houston Electric Light Co. has nearly completed its new model station at Lynn, Mass. Its plant at the start will comprise four dynamos, driven on the independent system by four Westinghouse automatic engines of 50 horse power each.

ATHLETICS UNDER THE ARC.—So successful were the recent athletic games given at the Boston Union Grounds, with the aid of the electric light, it is determined to repeat the experiment. This method of avoiding the summer heat and glare promises to become very popular.

THE THOMSON-HOUSTON IN THE WEST.—The Thomson-Houston Electric Light Co., of St. Louis, Mo., is increasing its plant by a 50 horse-power Westinghouse automatic engine. Council Bluffs, Ia., is now lit by the Thomson-Houston system, the dynamos being driven by Westinghouse engines.

AS A SURGICAL AID.—A boy at Portland, Me., got a piece of steel into his hand the other day. The surgeon took him to the Weston electric light station. A steel instrument was inserted in the wound and then magnetized. When it was withdrawn the fragment in the wound came out with it easily.

A POPULAR ENGINE.—The Marshalltown Electric Light and Power Co., Marshalltown, Ia., is now in successful operation. The power is furnished by a Westinghouse automatic engine of 65 horse power. The McKeesport, Pa. Electric Light Co. has started its new station, in which the power is furnished by two Westinghouse automatic engines of 50 horse power each.

AN IMPORTANT DECISION.—Judge Shipman has just filed his decision in a very important patent suit brought by the Brush Electric Company against users of the Weston electric light apparatus. The defense has been conducted by the United States Electric Lighting Company, manufacturers of the apparatus, and the trial has occupied nearly four years. The testimony taken covers over two thousand printed pages, and the oral argument before Judge Shipman in March last occupied eight entire days. The suit was upon the two principal patents granted to Charles F. Brush, one for metal-plated carbon points, and the other for an electric arc lamp, which, it was claimed, controlled the entire business of electric arc lighting. Before the argument the plaintiffs withdrew the carbon patent, and Judge Shipman now decides that the lamp patent is invalid and void and dismisses the bill, with costs, as to both patents.

THE POWER OF THE IMAGINATION.—While there are certain well-known dangers in connection with the system of lighting streets and buildings by electricity there is an unfortunate disposition shown to egaggerate this danger. An instance of this kind, remarks the Boston *Herald*, was given a day or two ago which well illustrates the readiness with which ignorance leads people to jump to false conclusions. Certain streets in South Boston are lighted by electricity, the company having in connection with its street service a telegraph line. Through some accident this telegraph wire was broken down so that a part of it fell upon the street. The report was instantly started that the electric light wire was broken, and people in the immediate vicinity considered that their lives were in danger. The fallen wire was as harmless as any piece of iron could be, and yet there were many willing to affirm that they received a severe shock from it. Indeed, from this slight accident any number of statements traveled abroad, and, no doubt, many who read or heard them were disposed to believe that the city government was guilty of gross neglect in permitting street travel to be in any way put in danger in this unnecessary manner. In reality, as we have said, no breakage of the electric wire occurred, and the shocks received were wholly shocks of the imagination.

A QUESTION OF SAFETY.—Much ado having been made in Boston over one or two little fires caused by electric light wires Mr. E. H. Goff, of the American Company, has written as follows to the Boston *Herald*: In your issue of yesterday an editorial appears on the fires recently caused in the Lawrence building and several other places by electric light wires, as claimed. At the close of the article appears this sentence: "But, in the absence of the safeguards, it must be admitted that electric lighting, under the system which caused these fires, is hardly a safe method, and hence underwriters and property owners would be abundantly justified in forbidding its use." This is all right, provided the system to be forbidden be specified, that the public may not be in doubt as to which system is dangerous and condemn all others indiscriminately. The system which caused this fire, and has caused several other similar fires in this city is that of the New England Weston Electric Light Company, and not that of the American Electric and Illuminating Company. The American company has in the past two years established fourteen or more central lighting stations in as many different cities in New England, aggregating over 3,500 lights (more than all other companies established in the same time combined), and has never had a fire or other accident of any description whatever, or caused one dollar's damage by its wires. Will you please state these facts for the benefit of the public and to supplement and complete your editorial alluded to above?

MISCELLANEOUS NOTES.

THE UTILITY OF ELECTRIC RAILWAY SIGNALS.—While the West Point cadets were practicing gunnery, recently, near the West Shore Railroad, a shot went about 100 yards wide of the target, struck a steel rail on the track, bent it double and tore it from its fastenings. The automatic electric signals at once gave warning, and the rail was replaced before any accident could happen to passing trains.

ELECTRIC TRICYCLES.—An attempt is being made in England, in a modest way, to utilize electricity as a motive power for tricycles, the prospectus of a company having been issued. It is proposed that 100 persons bind themselves to buy an electric tricycle at $250, or, in other words, that shares of $250 each be issued, each holder of a share being entitled to be supplied with an electric tricycle. The first machine to be produced is an electric tricycle carrying two persons and fitted with battery and motor sufficient to propel it on level ground at the rate of six miles an hour.

FOR WORKING STREET RAILWAYS.—Mr. Reckenzaun, the *Engineer* is informed, is endeavoring to overcome the various difficulties connected with the use of secondary batteries, and has worked out a system for working street railways electrically at a smaller cost per mile than is possible either with horses, steam or compressed air. The rails laid down for horse traction are sufficiently strong for his car, and the load is distributed in such a way that with a car loaded to its maximum number of 46 passengers the pressure upon any pair of wheels will not exceed two and one-half tons. The motor, which was exhibited at the Society of Arts, London, is light in comparison to the power it develops.

TRANSMISSION IN SAXONY.—One of the most remarkable instances of the transmission of power by electricity is that presented by the electric railroad in one of the main crosscuts of the Oppel colliery, Saxony. This crosscut is 2,362 feet long, and is the outlet for the coal mined in the vein, the quantity delivered to it being six hundred mine cars per day of sixteen hours, each car weighing, loaded, 1,594 pounds. A train of fifteen cars is moved at a speed of from seven to ten feet a second, the steam engine at the mouth of the shaft making from 225 to 520 revolutions during the run, lasting from three and one-half to four and one-half minutes through the crosscut. When doing this amount of work the steam engine delivered 11.2 horse power; or, assuming the friction of the engine's gearing to have occasioned a loss of twenty-five per cent., the power actually transmitted by the electric current to the locomotive was 5.22 horse power, or 46.6 per cent.

UNSCIENTIFIC ELECTRICAL UNITS.—The report of the electrical congress is something of a disappointment, thinks *Science*. The congress seems to have reached its conclusions in undue haste. Indeed, the electrical units as now defined are less precise and scientific than before. The reference of the practical units to those of the C. G. S. system was in itself admirable and satisfactory. With the new definitions, one only, that of current strength, has a precise relation to the fundamental units; the others have become arbitrary. Would it not have been better to adhere to the original ohm, and to define the mercury unit as provisional? The new mercury unit is obtained from measurements that differ among themselves by more than two per cent. Besides, the verdict was made up before the results of Prof. Rowland's exhaustive investigation, now in progress, were in the possession of the congress, although this investigation was admitted to be one of the most important. A provisional mercury unit of a hundred and six centimetres would have satisfied all practical demands, and would have been subject to such correction as future research indicated to be necessary. As the matter now stands, the elegance and simplicity of the system is destroyed by the introduction of arbitrary units, the value of which may some time be found to be considerably different from that now assumed.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

TELEGRAPH.—Am. Cable, b 50, a 51; Bankers and Merchants', a 30; Mutual Union, b 11, a 13; Western Union, b 53⅝, a 53¾; Postal, b 4⅝, a 4⅞; Postal 6's, b 39, a 40.

The gross earnings of the Mexican Telegraph Company for the week ended June 12, were $8,518, and those of the Central & South American Company, $5,905.

TELEPHONE.—American Bell, b 153; Erie, a 17; New England, a 19; Mexican, b 1¾; Tropical, b 1⅜, a 1½.

ELECTRIC LIGHT.—American, b 10; Edison, b 80, a 100; U. S, b 75, a 95.

The Boston *Globe* of July 10 says: Some 240 shares of American Electric and Illuminating preferred stock came out in today's auctions and were eagerly snapped up by investors at various prices from 9 to 10, which last is par. The subscription to the block of $100,000 of this stock offered by the company at par closes to-morrow, and we learn that the entire amount has been taken and that certain solid financiers would have taken up any unsold balance. The few shares of common offered sold at 2, at which price it is a 20 per cent. investment.

Kohlsaat & Co., No. 30 Pine street, furnish the following quotations for miscellaneous securities:

	About.		About
American Elec. Light.....	9	Mexican Telephone.....	20
American Bell Telephone...151		People's Telephone.....	20

BUSINESS NOTICES.

THE NATIONAL ELECTRIC CO., of Washington, D. C., whose advertisement appears in this paper, has recently moved to larger and better quarters which its increasing business required. Its new location, which is opposite the Telephone Exchange, is one of the best in the city. The company is doing an extensive business in putting up a great variety of electrical apparatus, and has large contracts for furnishing supplies to the Government. George C. Maynard continues with the company as electrical engineer and active manager.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

Edited by N. S. KEITH, Electrical Engineer and Expert, 9 Murray Street, New York.

PATENTS DATED JULY 1, 1884.

Cable for Telegraphic and Other Purposes; A. Wilkinson, of London, England 301,417
Copper wire is coiled to make a tube of any length, and then so turned that a tight tube is obtained. This is then insulated, made into a cable with other wire, etc. The copper-tin tube is used for conveying gas or liquids.

Conduit for Electric Conductors; L. Bannister and L. Blodget, of Philadelphia, Pa. Blodget Assignor to Bannister..... 301,203
Posts, with pins, etc., are provided within the conduit.

Carbon for Incandescent Electric Light; N. S. White, Canton, Mass..... 301,172
The carbon filament is coated with metal particles.

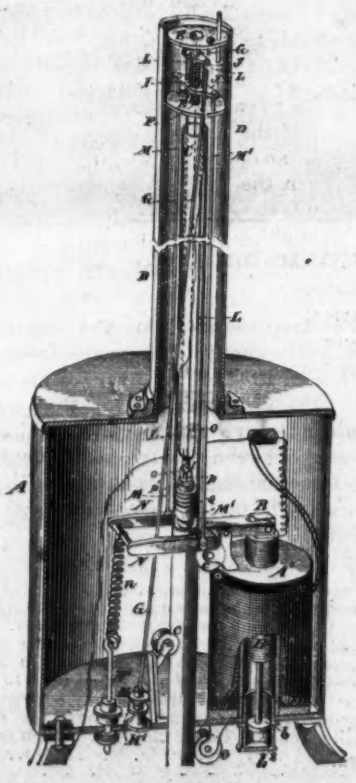
Electric Gas Lighting Apparatus; Wm. H. Sawyer, Providence, R. I..... 301,393
An automatic gas lighter and burner combined.

Electric Railroad Signal Apparatus; A. W. Hall, of Meriden, Ct., assignor to Hall Railway Signal Co..... 301,361
Details of apparatus allied to those which indicate safety only when the electro-magnets are energized.

Insulator for Electric Wires; A. W. Hale, of Plainfield, N. J..... 301,446
Glazes the parts of hooks, etc., which are exposed to the atmosphere.

Railway Switch and Signal Mechanism; C. H. Jackson, Allegheny, Pa..... 301,369
Combines an electric lock actuated by train movement with any movable interlocking member of an interlocking machine.

Regulating Device for Electric Lamps; E. A. Sperry, of Chicago, Ill..... 301,175
When the electric current is sent into the lamp and traverses the helix *A'*, the soft iron core *B* is drawn downward into said helix, depressing the short arm and raising the long arm of the lever *N*, which in its movements raises the slide *J'* by means of



the rods *M* and *M'*, and the said slide *J'* thus tends to compress the spring *I*; but it being already held in a compressed condition by the wires *K K*, so that its tension is more than is required to raise the combined weight of the plunger, the cylinder and its fluid, the slide *J* is also raised simultaneously with the slide *J'*, and through the loop *L* raises the plunger *Q* on the interior of the cylinder *C*. The wire *O* is of such a length, and the diaphragms and the tube *F* are adjusted to such a height by the rod *G* that the valve *P* is supported by the rod *O* and link *p* a short distance above its seat on the plunger *Q*. Now, the said plunger, in ascending as above stated, first encounters its valve, which stops the circulation of the fluid through the plunger, and thus prevents the further independent rising of said plunger, and the cylinder *C* is compelled to rise therewith, so that the upper is separated from the lower carbon, and the arc is established. When the resistance of the arc becomes such that the feeding of the upper carbon becomes necessary, an increased flow of the current occurs in the shunt-coil, which is carried by the soft-iron core *B*, and the magnetic effect of the helix *A'* on said core is so neutralized that the spring *n* is allowed to draw downward the long arms of the lever *N*, and thus the slides *J* and *J'* are allowed to descend, the descent of the loop *L* at the same time allowing the plunger, and with it the cylinder *C*, to descend a distance equal to the length of the link *p*, and when the upper end of said link strikes the bottom of the hook *n* a further downward movement of the plunger will cause it to leave its valve, and the passage through said plunger will be thereby opened to its normal extent of opening, which is very slight. If the passage through the plunger were entirely closed, the tendency of the cylinder to descend would tend to form a vacuum under the plunger, and this would result in the full arrest of the cylinder. The slight normal opening of the valve, however, allows a slow flow of the liquid from the upper to the lower side of the plunger and a correspondingly slow descent of the cylinder is thus allowed to occur by force of gravity. This slow movement effects a feed of the upper carbon.

Secondary Battery; D. G. Fitzgerald, of Brixton, England..... 301,351
A perforated sheet of insulating material, adhering to the face of the electrode, is placed so that attacks on the electrode take place only beneath the perforations.